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DESCRIPTION OF THE PROPERTY AND OPERATIONS OF THE LEWISTON DREDGE, LEWISTON, CALIF.

BY

LAWRENCE K. REQUA

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DESCRIPTION OF THE PROPERTY AND OPERATIONS AT THE LEWISTON DREDGE, LEWISTON, CALIF.[1]

By Lawrence K. Requa[2]

INTRODUCTION

The property being worked by the Lewiston dredge of Placer Development (Ltd.) is on the Trinity River in Trinity County, Calif., about 9 miles north of the town of Lewiston (see fig. 1). The nearest rail point is at Redding, Calif., which is exactly 50 miles by road from the dredge camp. Recently a very good section of State highway has been constructed from Redding to Weaverville, and it is now possible to use this highway for 35 miles of the distance between the dredging property and Redding. The remaining 15 miles, however, are over ordinary dirt road. No trouble is experienced in reaching the property except for a few weeks during the middle of the winter when snowstorms may make travel difficult but not impossible.

At present the property consists of about 500 acres of patented land, which extends for about 3 miles along the main Trinity River and Stuart's Fork. It is being worked with one 7-cubic foot, Bucyrus-type dredge, which has an average monthly capacity of about 100,000 cubic yards.

To the end of 1931 approximately 10,000,000 cubic yards of gravel had been dredged.

HISTORY OF OPERATION

The present dredge, which was built by the Lewiston Dredging Co., a subsidiary of the Metals Exploration Co., began operation in January, 1923. The machinery formerly used in the Valdor dredge, which operated at Junction City on the same river, was installed in this hull. The dredge was worked by the Lewiston Dredging Co. until January, 1929, at which time it was acquired by Mark L. Requa, trustee for R. F. Lewis and L. K. Requa, who operated it until August, 1930. At that time operations were taken over on a lease basis by Placer Development (Ltd.) which is working the property at present.

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[1] - The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from U. S. Bureau of Mines Information Circular 6660."

[2] - One of the consulting engineers, U. S. Bureau of Mines, and geologist.

Another placer operation in this area is that of the Trinity Dredging Co., whose property adjoins on the south that which was first worked by the Lewiston Dredging Co. The Trinity Dredging Co. is using a flume-type dredge. Also considerable work has been done in this area by hand and hydraulic methods, both in the present river channel and on segments of an old high channel. As the greater part of this work was done many years ago, there is no authentic record of what was produced. Judging from the area worked and the ditches installed, much of it must have been profitable.

TOPOGRAPHY

The dredge camp is at an elevation of 2,000 feet above sea level. The relief of the country on either side of the river is rough and precipitous, and the course in which the river flows is generally fairly narrow. Occasional meadows range from a quarter to a half mile wide, and it is in these meadows that the best operating results are secured. There are three of these meadows on the property, two of which have already been worked. The dredge is now entering the third and last one.

All of the dredging land is covered to a greater or less extent with timber, consisting of small pine and cottonwood, which has to be cleared in advance of the dredge.

GEOLOGY

The bedrock in this area is mostly a series of Paleozoic rocks which occur extensively in this part of the State. Locally the series consists of meta-andesite, sometimes classified as "greenstone," and slate. The greenstone constitutes the bedrock under most of the area being dredged. It is extremely hard and in many places in the narrow channel is quite rough. It does not make a very good gold catcher and as a consequence the best concentration of gold may be found anywhere from 1 to 15 feet above the bedrock. Moreover, due to hardness of the bedrock and to its roughness in places, it is very difficult if not impossible to clean it thoroughly. The slate, on the other hand, is a good gold catcher, and is easily dug.

The depth of the gravel to bedrock ranges from 10 to 45 feet. In the broader meadows the depth probably averages between 35 and 40 feet, while in the narrower parts of the river channel the dredge has on numerous occasions passed over bedrock with only a foot or two to spare.

The bank carried in front of the dredge ranges in height from 0 to 15 feet. At times, when digging in the river, the upper edge of the cut is a foot or two under water.

The pay gravel occurs in a fairly well-defined channel. At the extreme southern end of the property, first worked by the original company, this channel was 800 feet wide. Where recently worked, however, the pay streak ranges from 100 to 400 feet in width. Within this pay channel the values are spotty, which seems to be a characteristic of the Trinity River.

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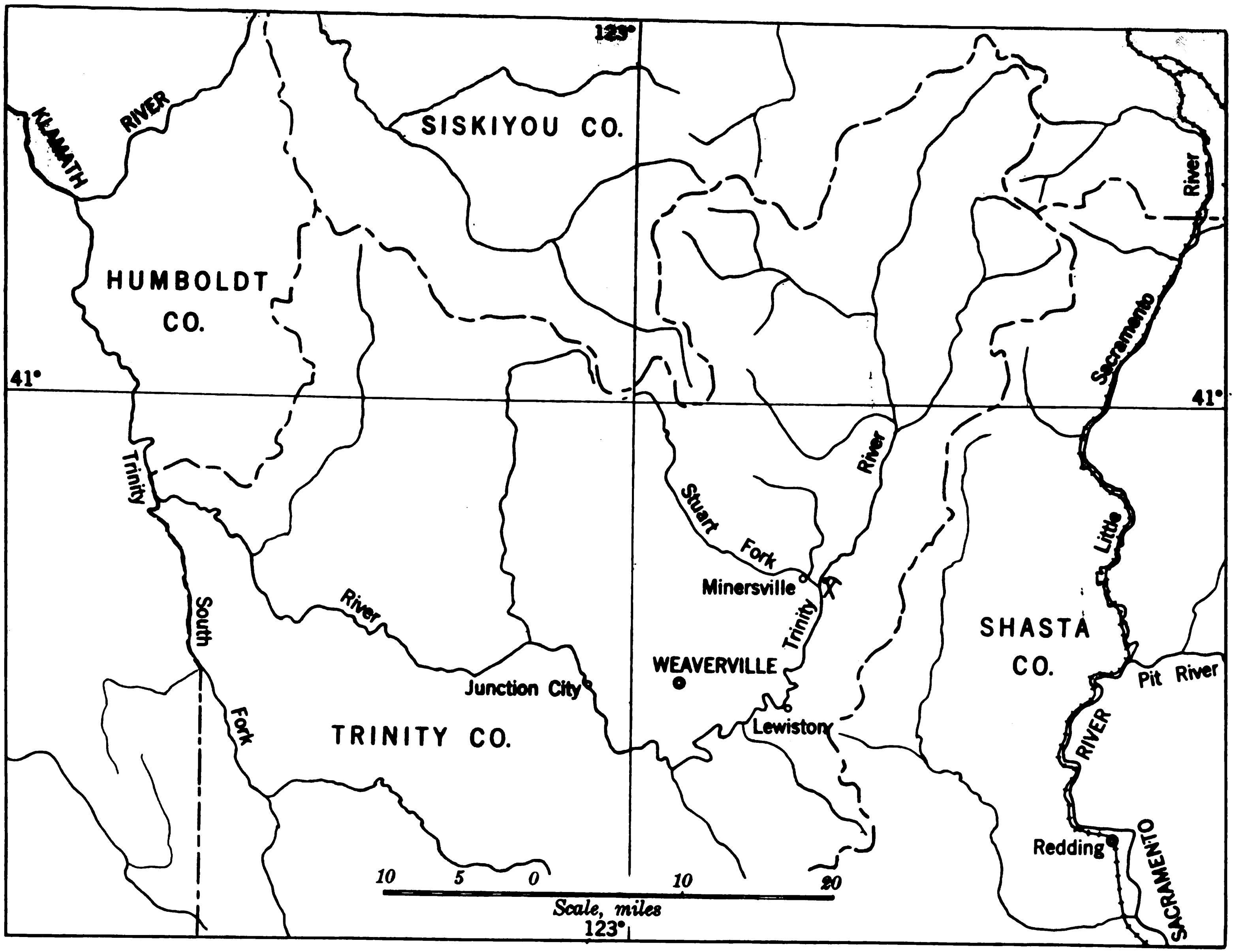

Figure 1. Northern Trinity County, Calif.

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Remnants of an older channel that existed at one time in this drainage area are easily seen, as they were extensively hydraulicked by the early miners. This channel was from 20 to 30 feet above the bed of the present Trinity River and apparently was considerably richer than the present channel. It has been observed that the dredge clean-ups frequently improve when working near a segment of the older channel.

The gravel is for the most part easily dug. Large bowlders occur, but not frequently enough to cause any appreciable delay. Clay when it does occur usually is brick-red in color, but is not sticky enough to remain in the buckets or to cause any difficulty in washing. This red clay generally is found at the surface. Some light-grey bedrock clay has been encountered, but this is even less sticky than the red clay and disintegrates easily on washing.

The numerous stumps left after the clearing of the dredging area are allowed to fall into the dredge pond and will usually float around the dredge, though occasionally one fouls the bucket line and has to be removed by the crew.

The greatest difficulty in operating has been due to the occurrence of cemented gravel. This "cement" is found in lenticular patches at or near bedrock, usually in the narrower parts of the river channel, not in the deepest part of the channel but flanking it. Isolated occurrences of "cement" are encountered in the larger flat areas of the deposit but are not common there.

The water level in the dredge pond corresponds closely with the level of the water in the river even when the dredge is a considerable distance from it. The gravel is quite permeable, as denoted by this fact and also by the fact that shaft-sinking has always been difficult here because of excessive water.

CHARACTER OF THE GOLD

In the last 2-1/2 years of operation the fineness of the gold ranged from 777 to 918, with an average of about 900. The coarseness of the gold is about medium. Well-worn nuggest up to $3 in value are not uncommon; the largest one found recently was worth about $8. Under a glass a considerable number of spicules or fine particles of wire gold are often noted in the fines recovered in sampling churn-drill holes. Platinum has not been observed.

PROSPECTING AND SAMPLING

The property was sampled in three stages: (1) The southern end of the property was drilled by the Metals Exploration Co. prior to the time that the dredge was built in 1923. About 100 churn-drill holes were put down at that time. A few shafts were sunk but the greater part of the prospecting was done with a steam-driven Keystone portable rig, using standard prospecting casing with an inside diameter of 6 inches. The holes were spaced 125 feet apart in roughly parallel rows 750 feet apart, as shown in Figure 2. (2) The upper ground was prospected by the Shasta Dredging Co. in 1922, using the same rig that was used in prospecting the ground of the Metals Exploration Co. Over 60 holes were put down in rows about 900 feet apart with the holes spaced 150 feet from each other. (3) When the present owners were investigating the possibilities of dredging from the lower to the upper ground, 27 churn-drill holes were sunk in the 8,000-foot interval between the two previously prospected areas. The rows of holes were about 750 feet apart and the holes were spaced 125 feet from each other in the rows. The same drill rig was used in this prospecting that had been formerly used.

The cost of prospecting can be stated only for this last stage of the work, which was done in 1928. The wage-scale was as follows:

	Per day	
Driller	$6,	plus board and transportation.
Panner	$6,	do.
Fireman	$5,	no board nor transportation.

The cost was $7.23 per foot. This included the salary of the engineer in charge and the entire cost of a new string of drill pipe--which, however, was not worn out in the prospecting.

SAMPLING OF THE DRILL HOLES

Logs of each hole were kept on standard log forms, which showed the number of 1, 2, or 3 size colors obtained in each pan, as well as the character of the formations penetrated, the volume of core removed as measured in a graduated pail, and the excess core, if any. Excess core, resulting from loose gravel sloughing into the hole, was compensated for in the calculations by a proportionate scaling-down of the values recovered by panning.

In the first two prospecting campaigns the Radford formula was used, with the factor 0.27. This formula may be written $V = \frac{R}{L \times f} \times 27$, in which V = average value of the gravel drilled through, in cents per cubic yard; R = total gold recovered from the drill sludge, in cents; L = total length of hole under consideration; f = a factor expressing the effective area of the cutting shoe on the casing, which in this instance, with standard 6-inch casing, is 0.27 square feet; and 27 is the factor to convert from cubic feet to cubic yards. As it was believed that the factor 0.27 gave too high results, 0.3068 was used in the last stage of prospecting. This figure is one developed by the Keystone Driller Co., and is in common use.

For the purpose of calculating the yardage and average value of the entire deposit, the latter was divided into blocks. The average foot-cent value of all the holes in each block was calculated and this value was assigned to the block. From the number of yards in each block and the average value, it was possible to calculate the average value of the entire deposit.

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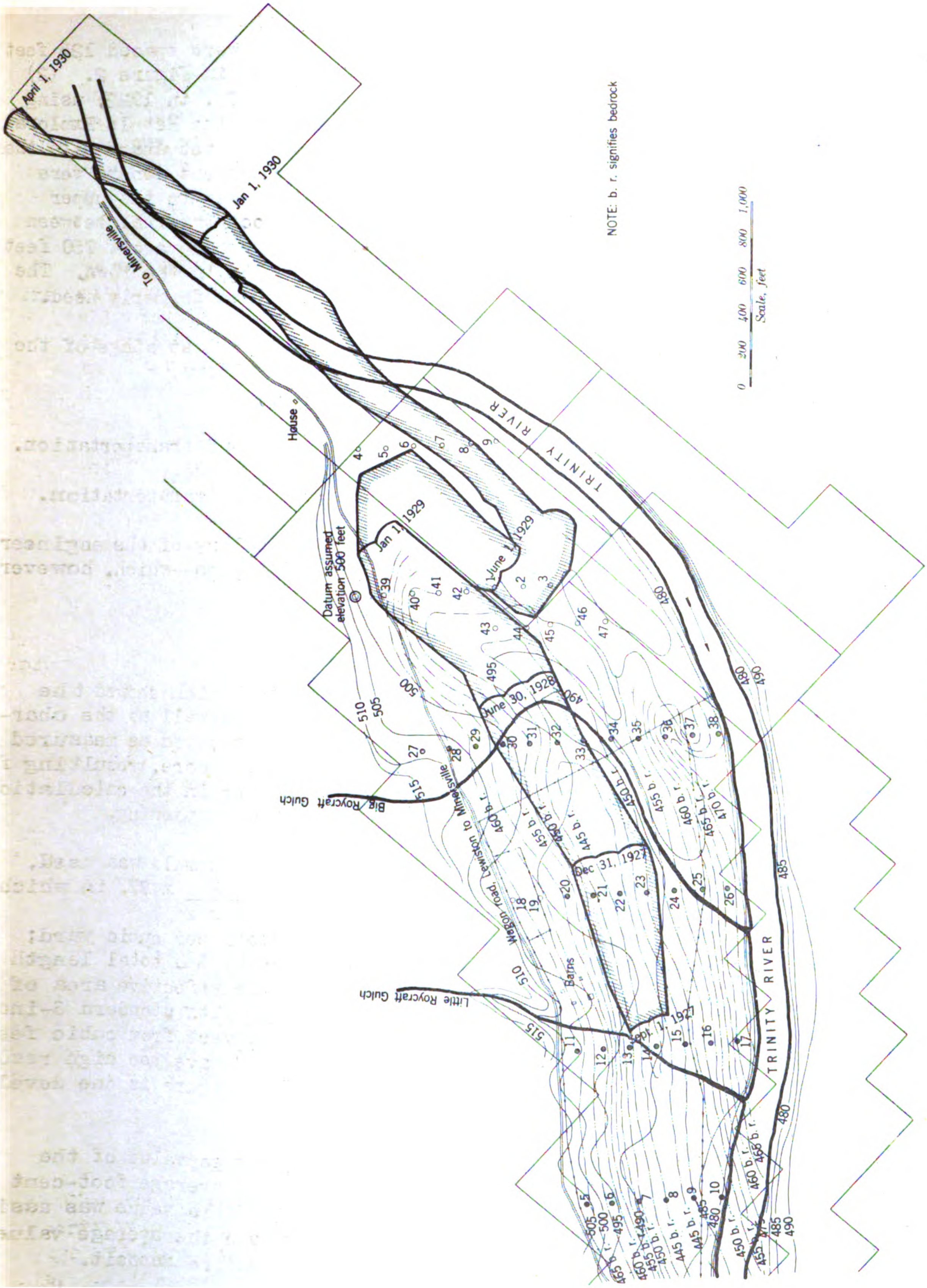


Figure 2.—Map of Lewiston dredge operations

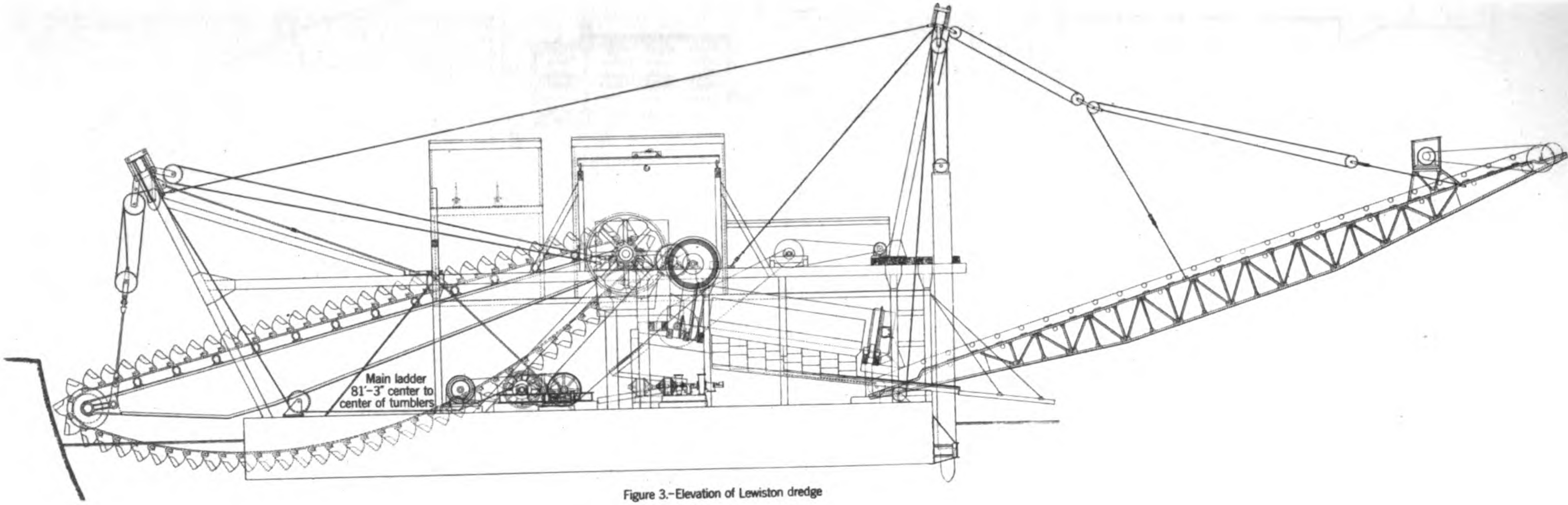


Figure 3.–Elevation of Lewiston dredge

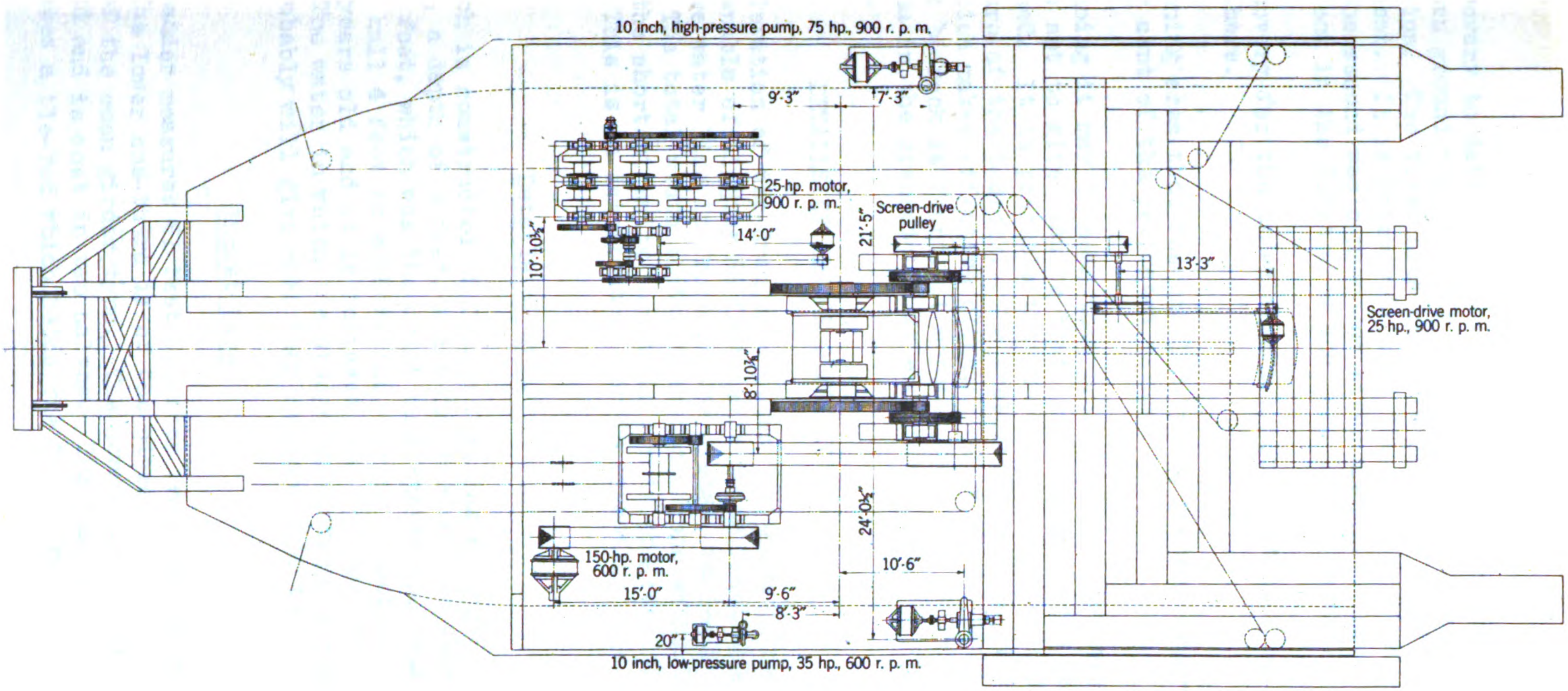


Figure 4.—Plan of Lewiston dredge

The dredge recovery to date has not equalled the estimated value. In the lower or southern ground the property was divided into two parts for the purpose of calculation. The first area showed a recovery of 77 per cent and the second 58 per cent. It is noteworthy that the first area consisted of a wide meadow and the second was a narrower river channel. Moreover, there was some slate bedrock in the first area and none in the second.

The dredge recovery for the upper area can not be stated, as dredging is just now starting there.

In the intervening area that was sampled by the present owners the dredge recovery was 62 per cent of the estimated value.

From the foregoing it may be seen that prospecting on the Trinity River in this vicinity is apt to give results that are too high, even when the pipe factor 0.3068 is used. It is probable that the low recoveries noted are due largely to the nature of the bedrock. The greenstone surface is hard and in places is rough, which makes effective cleaning of it almost impossible. Where slate or soft bedrock is found, it appears that the recovery improves. Recently a soft area in the greenstone was encountered and the recovery showed improvement.

DETAILS OF DREDGE CONSTRUCTION

The general elevation of the dredge is shown in Figure 3, and a plan in Figure 4. It is capable of digging 38 feet below water level and can carry a 15-foot bank above water line in front of the dredge, making a total digging depth of 53 feet. The total width that can be dug in one swing is slightly over 200 feet and the shortest swing that will permit progress of the dredge is about 90 feet. This is an important factor in operating in a narrow river channel.

Details of Hull

The hull, which is constructed of Oregon fir, has a length of 100 feet, a width of 43 feet, a depth of 9 feet, and a draft of 8 feet (the drawing shows a draft of 6 feet, which was the draft when operations began). The deck overhangs the hull 4 feet on either side, giving a deck 51 feet wide. The boat is 8-1/2 years old and it is believed that the hull will last about four years more. The water in which the dredge is working is always cool and this factor probably will give more than average life to the hull.

Bucket Line

The digging ladder measures 81 feet 3 inches from tumbler center to tumbler center. The lower one-third is of the closed girder type and the upper two-thirds of the open girder type. The lower tumbler is of manganese steel. It is round and is cast in two halves. The tumbler shaft is hollow, and through it passes a tie-rod which holds the ladder points together.

The upper tumbler is hexagonal, and the most noteworthy feature is that wearing plates of ordinary mild steel are used. Formerly Mayari steel plates were used, but it was found that due to their extreme hardness and the inability to seat them perfectly to the tumbler faces, they frequently would crack. Also there was considerable slippage of the bucket line when hard digging was encountered. L. Picard, chief mechanic at the dredge, suggested the use of the mild steel plates. This was a radical step, as it was thought generally in dredging circles that mild steel would not stand up, also that it would flow under the pressure of hard digging. The plates installed were of ordinary mild steel and were 2 inches thick. They were bolted and welded into place. The results have been more than satisfactory, as the average life of each wearing plate has been from four to six months and there has been no sign of flowage under pressure from hard digging. The plates seat well to the tumbler faces, the bucket line runs more smoothly and quietly than formerly, and the buckets slip and wear less.

The lower tumbler is lubricated through a grease pipe extending along the side of the ladder, by means of a high-pressure grease gun. The rollers, weighing 742 pounds each, are lubricated by grease cups.

There are 72, 7-cubic foot buckets in the bucket line, each weighing over a ton, as follows:

Part	Weight, pounds	Material
Bucket	1,545	Manganese steel
Lip	325	Do.
Bushing set	26	Do.
Pin	147	Mayari steel

The average life of a bucket lip is 8 to 12 months. After considerable experimenting, it has been found possible to weld the bucket eyes successfully after signs of fracture appear.

The digging ladder is driven by a belt-connected, variable-speed, 150-hp. motor. The ladder-hoist winch is likewise geared to this motor, but in such a way that the hoist can be run independently of the bucket line.

The movements of the dredge are controlled by an 8-drum winch, belt-driven by a 25-hp., variable-speed motor. From this winch run the four bow and stern swing lines, and the lines to raise or lower the spuds.

The main drive and winch motors are operated through controls in the front of the pilot house. The screen drive and stacker drive are similarly connected to controllers in the rear of the pilot-house. The pump switchboards are situated on the deck close to the pumps.

The power cable comes on board at the stern on the port side, where the main oil switch is placed. Thence it passes up the port side to a bank of transformers opposite the pilot house.

DREDGE OPERATION

As indicated before, the dredge is operating in a relatively narrow river channel and a large part of the dredging is done carrying only one cut (about 200 feet); however, in the wider meadows three cuts have been carried with a total width of over 400 feet. Frequently one side of the dredge pond is open to the river and as a consequence no pump is needed to supply water to the pond.

The actual capacity of the dredge varies from 90,000 to 120,000 cubic yards per month, with an average of about 100,000 cubic yards. The character of the digging is primarily responsible for the variation. If bedrock is unusually hard and rough or if cement is encountered it cuts down the yardage materially. In a few parts of the dredging area an escessive amount of sand and clay overburden was encountered, which necessitated dry washing for short distances. Dry washing is screening without water, which causes most of the gravel to pass through the screen as oversize.

Dredging in a narrow river gorge presents problems which are unknown to operators who are working large flat areas. One of the most difficult problems is to so plan the progress of the dredge that it will not be necessary either to cross the river or to work unprotected in the river during the winter months when high water and sudden freshets are likely to occur. To date it has been possible to meet this problem successfully, and as the dredge is just through the last narrow portion of the river no more difficulty from this source is expected, but for all operators considering properties on similar rivers it is a factor that should be given due consideration.

As previously stated, at times excessive amounts of sand and clay in the overburden have caused trouble. During one stage of the operation when the dredge was digging from the main river into a high sand bank, the fines going through the sluices were so excessive that the stern of the dredge grounded. As the rear of the dredge pond was open to the river, it was necessary to construct a gunny-sack dam and raise the water in the dredge pond about 1 foot. Dry washing was then resorted to until the dredge was far enough ahead to block effectually the rear of the pond with tailings. The level of the pond was then raised slowly and as the proportion of fines decreased, which it fortunately did, it was possible to resume normal digging.

Under ordinary circumstances an average of about 90 per cent running time is maintained. There have been a few big repair jobs in recent years that have pulled this percentage down considerably, but with nothing but the ordinary routine repairs the above running time is sustained. There have also been times when the physical characteristics of the deposit have caused considerable lost time. No great amount of trouble has been caused by bowlders. Those brought up in the bucket line, which the winchman believes are too large to go over the stacker, are removed by the crew on the forward deck. If a bowlder is encountered which is too large for the bucket line to bring up, it is worked over to one side of the pond.

Of the total time lost, about a fifth is charged to clean-up operations, and an equal amount to moving and other work on the shore lines which control the movement of the dredge. An analysis of lost time in the first six months of 1930 is as follows:

Total working hours	3,115
Hours shut down	438
Digging time, per cent of total working time	86

Cause of delay	Per cent of shut-down time
Bowlders	0.2
Buckets	4.7
Clean-up	17.0
Hopper	3.0
Ladder	2.3
Lines	20.0
Motors	5.5
Power lines	1.7
Power off	3.4
Pumps	0.7
Screen	7.4
Stacker	9.7
Stepping up	3.9
Spuds	1.6
Tables	1.4
Tumbler, lower	1.2
Tumbler, upper	0.8
Winches	6.0
Miscellaneous	9.5
	100.0

During the above period the dredge was shut down from January 13 to 17 because of cold weather, the chief difficulty being the freezing of the stacker. On March 4 a 12-hour shutdown resulted from high water in the river which made dredging dangerous. From May 9 to 17 the dredging ceased while a dam was built to raise the water in the pond, for reasons noted elsewhere. As this was an exceptional occurrence, and will not happen again, it was omitted from the above analysis.

A printed form of daily shift report (fig. 5) is filled out for each shift. This shows the men on shift, the hours each has worked, and the length of each shutdown and the cause. The men sign their names, with their time and overtime if any, and this is checked and signed by the dredge master. The height of bank at several places across the cut as well as the depth below water level that the dredge is digging are noted. Two types of depth indicators are used. One is an automatic recording device and the other a visual one consisting of a moving arrow on a graduated scale. The automatic record checks the length of shutdowns and the depths recorded by the winchmen from the visual one, but for purposes of yardage calculation the depths taken from the visual depth gage are used.

Yardage is calculated on each clean-up day for the period since the previous clean-up. A map on a scale of 50 feet to the inch is used to record the progress of the dredge. With transit and stadia rod the dredge cut is surveyed and then is plotted on the map. The area dredged is measured with a planimeter and by multiplying this by the average depth for the period covered, the total yardage is obtained.

GOLD-SAVING EQUIPMENT

The discharge from the main hopper goes directly to the screen, which is 30 feet 7 inches long, 6 feet in diameter, and set at 10 degrees from the horizontal. There are four sections to this screen, each section containing six manganese steel screen plates. The upper two sections of plates have 3/8-inch holes and the lower two have 1/2-inch holes. Obstruction rings of manganese steel are located between each section of screen plates and manganese steel lifter bars are placed between each screen plate. The screen is driven through its two forward 41-inch rolls by a belt-connected 25-hp. motor. It rotates in a clockwise direction, looking at it from the stern. The fines from the screen are discharged into the distributor, the trough of which is 12 inches wide. This in turn discharges onto a single bank of tables having eight sluices on each side. A high-pressure spray pipe extends the entire length of the screen and is directed slightly to the port side of the interior of the screen. Spray nozzles are also located at the openings of the distributor onto the tables.

The "save-all" sluices, as indicated in Figure 3, are on the deck directly below the upper tumbler and just back of the ladder well. The drip from the buckets falls upon a bar grizzly about 7 feet long and having a forward slope of approximately 40°. The oversize drops into the ladder well. The undersize is conducted to the forward end of a sluice box, about 9 feet long. This discharges into another box directly beneath but about 13 feet long and pitching forward so that it empties into the ladder well. Both boxes slope 1-1/4 inches in 12.

The transverse sluices are eight in number on each side of the dredge. Each sluice is 2 feet 7-1/2 inches wide and is set on a grade of 1.5 inches per foot. The transverse sluices discharge into four tail sluices, the outermost of which is outside the dredge housing. The other three are inside the housing and discharge through a 3-way tail sluice regulator, whereby the tailings can be either directed to port, to starboard, or directly astern as the occasion for spud ground demands. The tail sluices are likewise set on a grade of 1-1/2 in 12.

Hungarian-type riffles are used in the sluices. These consist of transverse wood strips 1 inch wide and 1-1/4 inches high, but beveled on top so that the upstream edge is only 1-1/8 inches high. Each is capped with a 1/4-

177

inch mild steel strap, 1-1/4 inches wide, which is set flush with the front edge of the riffle and projects 1-1/4 inch back of it. The side members are 1-1/4 by 1-1/4 inch strips.

Water for gold-saving operations is supplied by two 10-inch centrifugal pumps (Krogh, No. 10, type B, form E). One is a high-pressure pump, driven at 900 r.p.m. by a direct-connected, 75-hp. motor. This pump is on the starboard deck overhang just opposite the forward end of the screen. It has a capacity of 3,200 gallons per minute, taking water from the dredge pond through a short vertical-suction pipe and supplying it direct to the 10-inch header and the 15, 1-1/4-inch spray nozzles inside the screen. The other main pump is on the port deck overhang, likewise abreast of the forward end of the screen. It is a low-pressure pump, having a capacity of 3,000 gallons per minute, and is driven at 600 revoluations per minute by a 35-hp. motor. It is connected to the two 7-inch headers and the 16, 2-inch pipe nozzles which supply water to the distributor outlets on either side of the screen. A 4-inch centrifugal pump is located on the deck overhang just ahead of the low-pressure pump. This is driven at 1,200 revolutions per minute by a 5-hp. motor. It serves as both primary pump and bilge pump, having pipe connections to four bilge sections at the four corners of the hull, and overboard discharge and suction. This pump and both the large pumps are inter-connected by a 4-inch line, which likewise branches to hose connections at several points about the dredge.

The stacker belt is 32 inches wide and is 7-ply, 32-ounce duck with 5/16-inch top covering including the breaker strip and a 1/16-inch bottom covering. It is the practice to calculate the life of these belts in terms of the yardage carried and it is found that the average belt will carry slightly in excess of 1,000,000 cubic yards before it is worn out. The troughing rolls on the stacker are 3 feet 8 inches apart. Two bowlder retarders are situated, one about a third and the other about two-thirds of the way up the stacker, each having six steel fingers. These prevent bowlders from rolling down the stacker. The stacker is driven at a speed of 380 feet per minute by a 30-hp. motor which is housed at the upper end of the stacker. This end usually is about 37 feet above the level of the pond.

GOLD-SAVING OPERATION

There is nothing distinctive or unusual in the operation of the gold-saving plant. There is not enough clay in the ground to prevent the buckets from dumping their entire load, and as a consequence there is no trouble in washing the gravel clean in the screen. No attempt has been made to estimate the percentage of material discarded by the screen, so that it is impossible to state what this is.

After each clean-up the dredge is run until the riffles are fairly well filled up. Digging is then stopped temporarily while quicksilver is scattered on the upper part of the sluices in amounts that experience has shown to be sufficient.

No exact calculation of the amount of gold recovered in each stage of the operation has been made, but a very large per cent is known to be recovered in the upper half of the first two transverse sluices.

Ordinarily, clean-ups are made every 10 days. At every clean-up all of the riffles in the transverse sluices are removed. Each sluice is divided into an upper and lower part by two unremovable riffles. The contents of the sluices are worked down against these unremovable riffles with small hand hoes, and a considerable amount of the material is sluiced off. The remainder is scooped up and carried to the superintendent, who "boils it down" in a pail with the aid of a stream of water. The quicksilver and amalgam remain in the pail and the black sand is "boiled off." This is collected and put into sacks and carried to the gold house where it is run through a long tom containing a quicksilver trap. Lately long toms have been installed on the dredge and this part of the operation has been done there. The quicksilver and amalgam remaining in the pail and that in the trap of the long tom are placed in a canvas strainer and the quicksilver removed, the amalgam remaining in the strainer. The black sand remaining is saved up and run through an amalgam barrel about once in six months.

The amalgam is placed in a "bleeder," which is nothing more than a metal funnel about a foot high, constructed so that it will fit over a receptacle to catch the quicksilver that drains off. This operation has been found to shorten materially the time necessary to retort.

After the amalgam has been sufficiently "bled," it is placed in a retort and the quicksilver driven off, following which it is placed in a crucible, the temperature raised somewhat, and the gold melted. It is then poured into a mold.

The tail sluices are not cleaned up on every clean-up day and are sometimes not touched for a month. The save-all is cleaned up once a month.

As a precaution against theft all of the sluices are inclosed with heavy wire screening and are kept under packlock at all times. Full insurance is kept on the clean-up from the time it is collected in the form of amalgam on the dredge until it reaches the smelter.

REPAIRS

Routine repairs usually are made on clean-up day when the dredge is shut down. Every repair that would require the dredge to be shut down is anticipated, if possible, and everything is in readiness at this time, so that no further shutdowns and loss of running time will be incurred.

A machine shop is maintained at the dredge camp and all of the repairs, with very few exceptions, are accomplished on the property.

STREAM POLLUTION

Until this year (1931) it was not necessary to give any thought to stream pollution, due to the fact that the Trinity River, throughout its entire course, flows through a region in which agriculture is possible at only a few limited localities. None of the antidebris legislation that was in effect in other parts of the State applied to the Trinity River watershed.

Certain resort owners, mostly in Humboldt County, advanced the claim that the pollution of the Trinity River by the hydraulic miners and the dredges during the fishing season was detrimental to their interests. The controversy was carried to the State legislature, where after hearing the evidence of both sides a compromise bill was enacted. This bill provides that during three months in the summer, starting on July 15 of each year, the sediment in the river must not exceed 50 parts per million, by weight, at a point 1 mile below the Trinity - Humboldt County line (see fig. 1). It is thought that the placer properties will be able to continue operations through this period if considerable care is exercised, but as the first full season under this restriction has not gone by, it is impossible to say definitely.

POWER

Electric power is supplied to the dredge by the Pacific Gas and Electric Co. It's Redding-Eureka power line runs through Lewiston, from where a branch line runs up the Trinity River as far as Minersville. The power is supplied from the Redding end, except in case of trouble, when a small stand-by plant, located at Junction City approximately half-way between Redding and Eureka, is used.

Current is supplied at 60,000 volts to the dredge substation, where it is stepped down to 2,200 volts. Transformers on the dredge step this down further to 440 volts for use in the various motors. The power line is carried across the dredge pond on two floats, each made of four large oil barrels on a wooden frame.

No. 6 copper wire is used to carry the current from the dredge substation to the dredge. It was found that the greatest distance at which the dredge could work satisfactorily from the substation was about 1-1/4 miles. Beyond this distance the voltage was too low for efficient digging.

The power cost schedule that the dredge has been operating under recently is as follows:

Demand charge:

First 200 kw. or less of maximum demand	$300.00	per month
Next 300 kw. of maximum demand	$1.00	per kw. per month
Next 500 kw. of maximum demand	.75	do.
All over 1,000 kw. of maximum demand	.60	do.

Energy charge (to be added to demand charge):

First 150 kw.h.	per kw. per month	0.8 cent	per kw.h.
Next 150	do.	.6	do.
All over 300	do.	.5	do.

Demand: The maximum demand in any month will be the average kilowatt delivery of the 30-minute interval in which the consumption of electrical energy is greater than in any other 30-minute interval in the month. The maximum demand on which the demand charge and energy block will be based will not be less than 50 per cent of the greatest maximum demand occurring during the 11 preceding months.

The maximum demand in recent years has been 391.7 kilowatts. The actual cost for power figured on recent operations is 0.89 cent per kilowatt-hour, and the consumption of power per cubic yard of gravel dug was 1.65 kilowatt-hours for the same period.

The following is a tabulation of the electric motors on the dredge:

Motors	Speed	Horsepower	Revolutions per minute
Main driver	Variable	150	600
Swing winch	do.	25	900
Low-pressure pump	Constant	35	600
High-pressure pump	do.	75	900
Screen drive	do.	25	900
Bilge pump	do.	5	1,200
Stacker drive	do.	30	900
Shore pump	do.	25	-----

WATER SUPPLY

All water for dredging purposes is taken from the river. As the dredge is frequently working with at least one side of the pond open to the river, no shore pump is needed a good part of the time. At times when the dredge pond is not open to the river, water is supplied by a centrifugal pump direct-connected to a 25-hp. motor. At no time has it been necessary to convey water more than a quarter of a mile to elevate it more than 25 feet.

CREW

The dredge crew organization is as follows:

Superintendent
1 dredge master
1 chief mechanic
1 blacksmith
1 carpenter
3 winchmen
3 motormen
3 oilers
1 teamster

At times an extra man is employed on the day shift.

WAGE SCALE

The wage scale in the latter part of 1931 was as follows:

Dredge master	per month	$220.00
Chief mechanic	do.	250.00
Winchmen	per day	5.50
Motormen	do.	4.50
Oilers	do.	4.25
Blacksmith	do.	6.00
Carpenter	do.	5.50
Teamster	do.	5.00

ACCIDENT PREVENTION

Regular inspections of the property are made by the State safety engineer and his recommendations are followed as to safety-features. Compensation insurance is carried with the State fund.

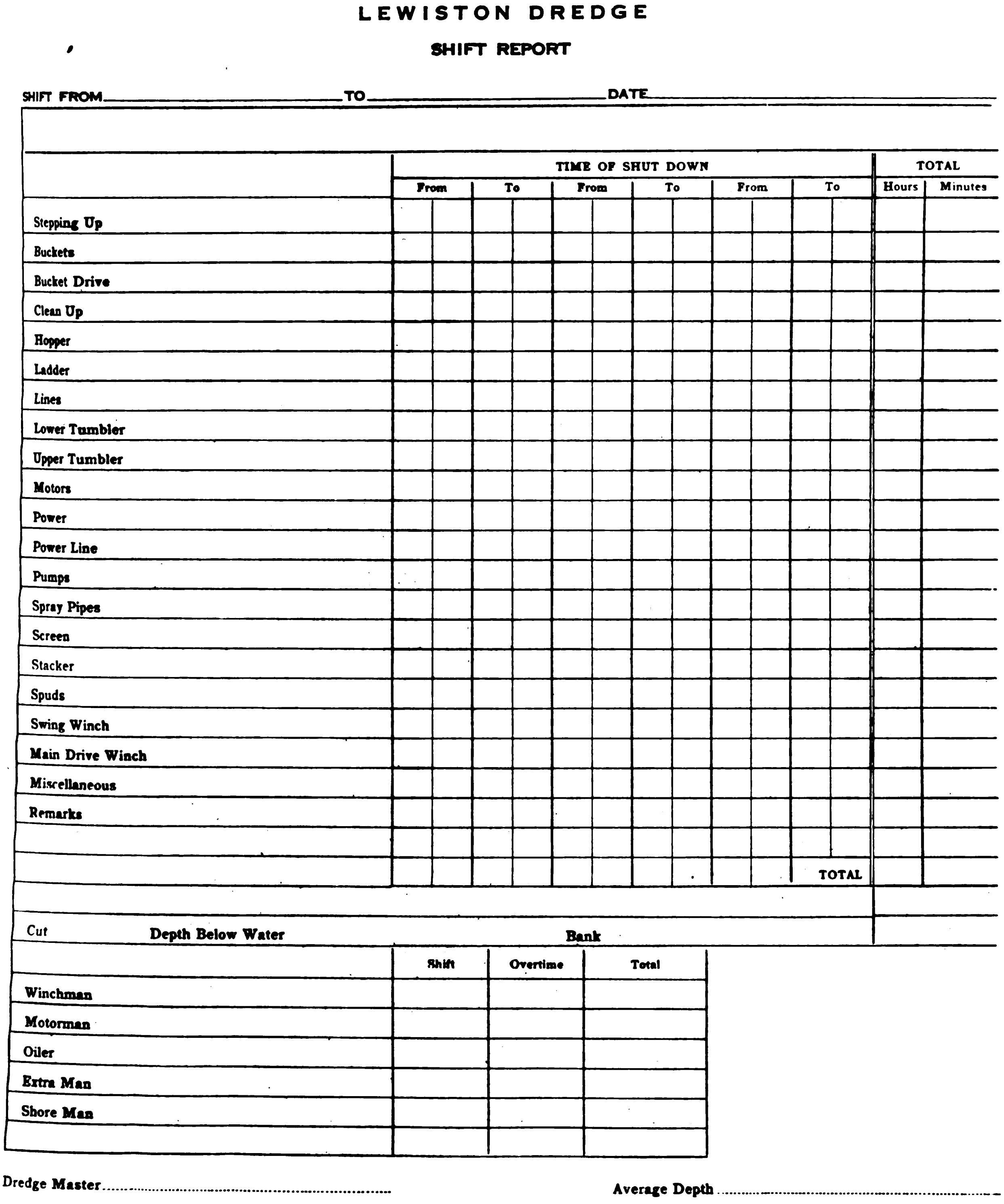
COST PER CUBIC YARD

Period covered: Jan. 1, 1929, to Oct. 1, 1931.
Cubic yards handled: 2,982,204.
Total operating cost for period: $241,396.29.
Cost per cubic yard (33 months): $0.0809.

The cost for the first 19 months was $0.0840, whereas the cost for the last seven months has been $0.0652. The principal reasons for the variation in costs were: (1) Certain physical difficulties in dredging during the early period; (2) several extensive repairs necessary in early period; (3) lower commodity prices during latter period.

For the year 1929 the cost per cubic yard was $0.0797, which was segregated as follows:

Labor	$0.0255
Superintendency	.0033
Supplies	.0325
Power	.0137
Office expense	.0003
Insurance	.0032
Taxes	.0012
	0.0797



LEWISTON DREDGE

SHIFT REPORT

SHIFT FROM ________ TO ________ DATE ________

	TIME OF SHUT DOWN						TOTAL	
	From	To	From	To	From	To	Hours	Minutes
Stepping Up								
Buckets								
Bucket Drive								
Clean Up								
Hopper								
Ladder								
Lines								
Lower Tumbler								
Upper Tumbler								
Motors								
Power								
Power Line								
Pumps								
Spray Pipes								
Screen								
Stacker								
Spuds								
Swing Winch								
Main Drive Winch								
Miscellaneous								
Remarks								
						TOTAL		

Cut Depth Below Water Bank

	Shift	Overtime	Total
Winchman			
Motorman			
Oiler			
Extra Man			
Shore Man			

Dredge Master .... Average Depth ....

Figure 5.— Daily shift report